

16. [Expansion]

Skill 16.1 Expanding brackets in expressions like $2(a + 1)$

MMMaive 11 22 33 44
MMLime 11 22 33 44

- Multiply the number outside the brackets by every term inside the brackets.
- Keep the sign from inside the brackets.

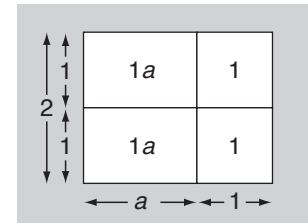
Expand the brackets

$$2(a + 1) = 2 \cdot a + 2 \cdot 1$$

Keep the sign

$$= 2a + 2$$

① ②



Q. Expand $5(2 - b)$

A. $5(2 - b)$
 $= 5 \cdot 2 - 5 \cdot b$
 $= 10 - 5b$

a) Expand $3(4b - 5)$

Expand the brackets

$$= 3 \cdot 4b - 3 \cdot 5 = 12b - 15$$

Keep the sign

b) Expand $2(z + 4)$

$$= 2 \cdot z + 2 \cdot 4 = \boxed{}$$

c) Expand $3(5 + w)$

$$= \dots = \boxed{}$$

d) Expand $7(n - 2)$

$$= \dots = \boxed{}$$

e) Expand $9(4 - u)$

$$= \dots = \boxed{}$$

f) Expand $5(e - 8)$

$$= \dots = \boxed{}$$

g) Expand $8(1 + 2a)$

$$= \dots = \boxed{}$$

h) Expand $4(2g - 6)$

$$= \dots = \boxed{}$$

i) Expand $2(2k - 3)$

$$= \dots = \boxed{}$$

j) Expand $9(2h + 3)$

$$= \dots = \boxed{}$$

k) Expand $3(4 - 6w + 4x)$

$$= \dots = \boxed{}$$

l) Expand $2(5 - 7d + 4e)$

$$= \dots = \boxed{}$$

Skill 16.2 Expanding brackets in expressions like $a(a + 1)$

MMMaive 1 1 2 3 3 4 4
MMLime 1 1 2 2 3 3 4 4

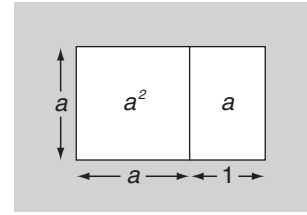
- Multiply the variable outside the brackets by every term inside the brackets.
- Keep the sign from inside the brackets.

Expand the brackets

$$a(a + 1) = a \cdot a + a \cdot 1$$

Keep the sign

$$= a^2 + a$$



Q. Expand $k(k - 6)$

A. $k(k - 6)$
 $= k \cdot k - k \cdot 6$
 $= k^2 - 6k$

a) Expand $a(2 - 2a)$

Expand the brackets

$$= a \cdot 2 - a \cdot 2a$$

Keep the sign

$$= \boxed{2a - 2a^2}$$

b) Expand $e(e + 4)$

$$= e \cdot e + e \cdot 4$$

$$= \boxed{}$$

c) Expand $r(9 + r)$

$$= \dots = \boxed{}$$

d) Expand $s(5 - s)$

$$= \dots = \boxed{}$$

e) Expand $d(d + 3)$

$$= \dots = \boxed{}$$

f) Expand $e(e - 7)$

$$= \dots = \boxed{}$$

g) Expand $a(1 + 2a)$

$$= \dots = \boxed{}$$

h) Expand $d(5d + 6)$

$$= \dots = \boxed{}$$

i) Expand $p(4 + 2p)$

$$= \dots = \boxed{}$$

j) Expand $z(6 - 6z)$

$$= \dots = \boxed{}$$

k) Expand $s(7t - 4s - 8)$

$$= \dots = \boxed{}$$

l) Expand $e(f + 4 - 9e)$

$$= \dots = \boxed{}$$

Skill 16.3 Expanding brackets in expressions like $2a(b + 1)$

- Multiply the term outside the brackets by every term inside the brackets.
- Keep the sign from inside the brackets.

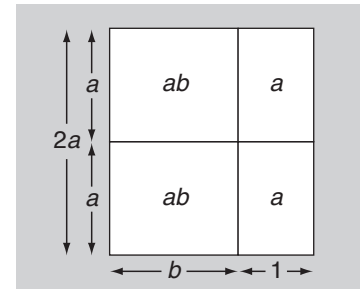
Expand the brackets

$$2a(b + 1) = 2a \cdot b + 2a \cdot 1$$

Keep the sign

$$= 2ab + 2a$$

① ②



Q. Expand $2x(x - 7)$

A. $2x(x - 7)$
 $= 2x \cdot x - 2x \cdot 7$
 $= 2x^2 - 14x$

a) Expand $2d(3d + 6)$

Expand the brackets

Keep the sign

$$= 2d \cdot 3d + 2d \cdot 6 = 6d^2 + 12d$$

b) Expand $3a(a - 5)$

$$= 3a \cdot a - 3a \cdot 5 = \boxed{}$$

c) Expand $5s(2 - 4s)$

$$= \dots = \boxed{}$$

d) Expand $3y(4y - 3)$

$$= \dots = \boxed{}$$

e) Expand $3k(5 + 2k)$

$$= \dots = \boxed{}$$

f) Expand $5g(2g - 4)$

$$= \dots = \boxed{}$$

g) Expand $4d(2d + 3)$

$$= \dots = \boxed{}$$

h) Expand $3a(7 + 2a)$

$$= \dots = \boxed{}$$

i) Expand $2q(6 - 2r)$

$$= \dots = \boxed{}$$

j) Expand $4i(6j + 4)$

$$= \dots = \boxed{}$$

k) Expand $7p(4p + q)$

$$= \dots = \boxed{}$$

l) Expand $5n(m - 5n)$

$$= \dots = \boxed{}$$

Skill 16.4 Expanding brackets in expressions like $-2a(b + 1)$

MMMaive 11 22 3 44
MMLime 11 2 33 44

- Multiply the negative term outside the brackets by every term inside the brackets.
- Use the sign rules: $++=+$ $--=+$ $+--=-$ $-+=-$ (see skill 8.3, page 91)

Expand the brackets

$$-2a(b + 1) = (-2a) \cdot b + (-2a) \cdot 1$$

The \cdot sign can be left out

$$= -2ab - 2a$$

Use the sign rules

① ②

Q. Expand $-2(x - 4)$

A. $-2(x - 4)$
 $= (-2) \cdot x - (-2) \cdot 4$
 $= -2x + 8$

---=+

a) Expand $-5m(m + 4)$

Expand the brackets

$$= (-5m) \cdot m + (-5m) \cdot 4 = -5m^2 - 20m$$

+--=-

b) Expand $-4(f + 3)$

$$= (-4) \cdot f + (-4) \cdot 3 = \boxed{}$$

c) Expand $-(b + 9)$

$$= \dots = \boxed{}$$

d) Expand $-3(r + 6)$

$$= \dots = \boxed{}$$

e) Expand $-8a(a - 2)$

$$= \dots = \boxed{}$$

f) Expand $-2w(3 + 4w)$

$$= \dots = \boxed{}$$

g) Expand $-7q(q + 3)$

$$= \dots = \boxed{}$$

h) Expand $-6b(4 - 5b)$

$$= \dots = \boxed{}$$

i) Expand $-2cd(2 - 3d)$

$$= \dots = \boxed{}$$

j) Expand $-tu(5t + 2u)$

$$= \dots = \boxed{}$$

k) Expand $-2s(8st + 3t)$

$$= \dots = \boxed{}$$

l) Expand $-3m(6mn - 4n)$

$$= \dots = \boxed{}$$

Skill 16.5 Expanding and simplifying expressions.

- Multiply the term outside the brackets by every term inside the brackets.
- Group like terms. (see skills 14.3, page 161 and 14.4, page 162)
- Use the sign rules: $++=+$ $--=+$ $+-=-$ $-+=-$ (see skill 8.3, page 91)

Q. Expand and simplify
 $2(ef - 5) + 4(ef + 3)$

A. $2(ef - 5) + 4(ef + 3)$ Expand the brackets

$$= 2ef - 10 + 4ef + 12$$

Group like terms

$$= 2ef + 4ef - 10 + 12$$

$$= 6ef + 2$$

a) Expand and simplify

$2(8c + 4) - 7c$ Expand the brackets

$= 16c + 8 - 7c$ Group like terms

$= 16c - 7c + 8 = \boxed{9c + 8}$

b) Expand and simplify

$3(2x + 1) + 4x$

$= 6x + 3 + 4x$

$= \dots = \boxed{}$

c) Expand and simplify

$2(x + 1) - 4x$

$= \dots$
 $= \dots = \boxed{}$

d) Expand and simplify

$4s + s(2s - 5)$

$= \dots$
 $= \dots = \boxed{}$

e) Expand and simplify

$3p(q - 6) + 4p$

$= \dots$
 $= \dots = \boxed{}$

f) Expand and simplify

$5z(y + 3) - 8z$

$= \dots$
 $= \dots = \boxed{}$

g) Expand and simplify

$5(hi - 3) - 8(hi + 3)$

$= \dots$
 $= \dots = \boxed{}$

h) Expand and simplify

$n(n - 5) + 3(2n + 7)$

$= \dots$
 $= \dots = \boxed{}$

i) Expand and simplify

$2b(b - 5) - 8(b - 5)$

$= \dots$
 $= \dots = \boxed{}$

j) Expand and simplify

$a(bc + 4) - 3(2a + 5)$

$= \dots$
 $= \dots = \boxed{}$

Skill 16.6 Expanding and simplifying more complex expressions.

MMMaive 11 22 33 44
MMLime 11 22 33 44

- Multiply the term outside the brackets by every term inside the brackets.
- Group like terms. (see skill 14.3, page 161 and skill 14.4, page 162)
- Use the sign rules: $++=+$ $--=+$ $+--=-$ $-+-=-$ (see skill 8.3, page 91)

Q. Expand and simplify
 $-2(t^2 - u) + 5t(t - 3)$

A. $-2(t^2 - u) + 5t(t - 3)$ Expand the brackets
 $= -2t^2 + 2u + 5t^2 - 15t$
 $= -2t^2 + 5t^2 + 2u - 15t$ Group like terms
 $= 3t^2 + 2u - 15t$

a) Expand and simplify
 $-4a(a - 2) + 7(a^2 - b)$ Expand the brackets

$= -4a^2 + 8a + 7a^2 - 7b$
 $= -4a^2 + 7a^2 + 8a - 7b = 3a^2 + 8a - 7b$
Group like terms

b) Expand and simplify
 $x(2x + 3) - 3(x + 7)$

$= 2x^2 + 3x - 3x - 21$
 $=$

c) Expand and simplify
 $3(2t - 4) + t(t - 2)$

$=$
 $=$

d) Expand and simplify
 $-2s(5s^2 + 3s) + (s - s^2)$

$=$
 $=$

e) Expand and simplify
 $tu(t - 1) + 8u(t^2 - t)$

$=$
 $=$

f) Expand and simplify
 $3e(f - e) + 8e(f^2 - e)$

$=$
 $=$

g) Expand and simplify
 $-6kl(k - 2) - 2l(2k^2 - 2k)$

$=$
 $=$

h) Expand and simplify
 $-5m(m - 1) + 6(m^2 - 1)$

$=$
 $=$

i) Expand and simplify
 $-8y(xy - 1) + 4xy(x + 2y)$

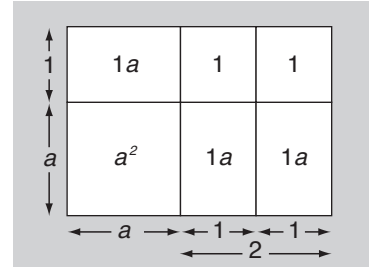
$=$
 $=$

j) Expand and simplify
 $-3(q^2 + q) + 4q(q + 1)$

$=$
 $=$

Skill 16.7 Expanding brackets in expressions like $(a + 1)(a + 2)$

- Multiply each term inside the first set of brackets by each term inside the second set of brackets.
- Simplify the products.
- Group like terms. (see skill 14.3, page 161 and skill 14.4, page 162)
- Use the sign rules: $++=+$ $--=+$ $+--=-$ $-+-=-$
(see skill 8.3, page 91)



$$\begin{aligned}
 \text{Expand the brackets} \quad (a + 1)(a + 2) &= a \cdot a + a \cdot 2 + 1 \cdot a + 1 \cdot 2 \\
 &= a^2 + 2a + a + 2 \quad \text{Simplify the products} \\
 &= a^2 + 3a + 2 \quad \text{Group like terms}
 \end{aligned}$$

Q. Expand and simplify
 $(w - 3)(w - 2)$

$$\begin{aligned}
 \text{A.} \quad (w - 3)(w - 2) &\quad \text{Expand the brackets} \\
 &= w \cdot w + w \cdot (-2) + (-3) \cdot w + (-3) \cdot (-2) \\
 &= w^2 - 2w - 3w + 6 \quad \text{Simplify the products} \\
 &= w^2 - 5w + 6 \quad \text{Group like terms}
 \end{aligned}$$

a) Expand and simplify
 $(h - 5)(h + 2)$

$$\begin{aligned}
 &= h \cdot h + h \cdot 2 + (-5) \cdot h + (-5) \cdot 2 \\
 &= h^2 + 2h - 5h - 10 = \boxed{h^2 - 3h - 10}
 \end{aligned}$$

b) Expand and simplify
 $(x + 3)(x + 1)$

$$\begin{aligned}
 &= x \cdot x + x \cdot 1 + 3 \cdot x + 3 \cdot 1 \\
 &= \dots = \boxed{}
 \end{aligned}$$

c) Expand and simplify
 $(w + 4)(w - 3)$

$$\begin{aligned}
 &= \dots \\
 &= \dots = \boxed{}
 \end{aligned}$$

d) Expand and simplify
 $(u + 4)(5 - u)$

$$\begin{aligned}
 &= \dots \\
 &= \dots = \boxed{}
 \end{aligned}$$

e) Expand
 $(f - 2)(g + 8)$

$$\begin{aligned}
 &= \dots \\
 &= \dots = \boxed{}
 \end{aligned}$$

f) Expand
 $(j - 5)(k - 3)$

$$\begin{aligned}
 &= \dots \\
 &= \dots = \boxed{}
 \end{aligned}$$

g) Expand and simplify
 $(2h - 4)(h + 5)$

$$\begin{aligned}
 &= \dots \\
 &= \dots = \boxed{}
 \end{aligned}$$

h) Expand and simplify
 $(2r + 6)(3r - 7)$

$$\begin{aligned}
 &= \dots \\
 &= \dots = \boxed{}
 \end{aligned}$$

Skill 16.8 Expanding brackets in perfect squares like $(a + b)^2$

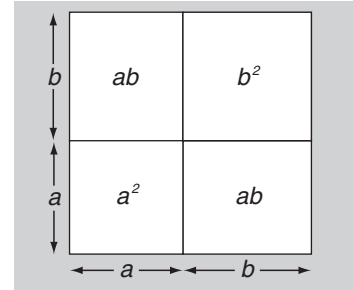
MMMaive 11 22 33 44
MMLime 11 22 33 44

- Multiply each term inside the first set of brackets by each term inside the second set of brackets.
- Simplify the products.
- Group like terms. (see skill 14.3, page 161 and skill 14.4, page 162)

OR

- Substitute values into the perfect square formula:

$$(a + b)^2 = a^2 + 2ab + b^2$$



Expand the brackets

$$\begin{aligned}
 (a + b)^2 &= (a + b)(a + b) = \overset{1}{a \cdot a} + \overset{2}{a \cdot b} + \overset{3}{b \cdot a} + \overset{4}{b \cdot b} \\
 &= \overset{1}{a^2} + \overset{2}{ab} + \overset{3}{ba} + \overset{4}{b^2} \quad \text{Simplify the products} \\
 &= a^2 + 2ab + b^2 \quad \text{Group like terms}
 \end{aligned}$$

Q. Expand and simplify
 $(n + 9)^2$

A. $(n + 9)^2$
 $= (n + 9)(n + 9)$
 $= \overset{1}{n \cdot n} + \overset{2}{n \cdot 9} + \overset{3}{9 \cdot n} + \overset{4}{9 \cdot 9}$
 $= n^2 + 9n + 9n + 81$
 $= n^2 + 18n + 81$

OR $(n + 9)^2$
 Using $a^2 + 2ab + b^2$
 where $a = n$ and $b = 9$
 $= n^2 + 2 \cdot n \cdot 9 + 9 \cdot 9$
 $= n^2 + 18n + 81$

a) Expand and simplify
 $(s + 4)^2$

$$= a^2 + 2ab + b^2 \text{ where } a = s \text{ and } b = 4$$

$$= \overset{1}{s^2} + \overset{2}{2 \cdot s \cdot 4} + \overset{4}{4^2} = \boxed{s^2 + 8s + 16}$$

b) Expand and simplify
 $(y + 1)^2$

$$= \dots\dots\dots = \boxed{}$$

c) Expand and simplify
 $(h + 2)^2$

$$= \dots\dots\dots = \boxed{}$$

d) Expand and simplify
 $(t + 6)^2$

$$= \dots\dots\dots = \boxed{}$$

e) Expand and simplify
 $(p + 7)^2$

$$= \dots\dots\dots = \boxed{}$$

f) Expand and simplify
 $(m + 5)^2$

$$= \dots\dots\dots = \boxed{}$$

g) Expand and simplify
 $(r + 8)^2 + 4$

$$= \dots\dots\dots = \boxed{}$$

h) Expand and simplify
 $(g + 3)^2 - 3g$

$$= \dots\dots\dots = \boxed{}$$

Skill 16.9 Expanding brackets in perfect squares like $(a - b)^2$

MMMaive 11 22 33 44
MMLime 11 22 33 44

- Multiply each term inside the first set of brackets by each term inside the second set of brackets.
- Simplify the products.
- Group like terms. (see skills 14.3, page 161 and skill 14.4, page 162)
- Use the sign rules: $++=+$ $--=+$ $+-=-$ $-+=-$ (see skill 8.3, page 91)

OR

- Substitute values into the perfect square formula: $(a - b)^2 = a^2 - 2ab + b^2$

Expand the brackets

$$(a - b)^2 = (a - b)(a - b) = \overset{1}{a} \cdot \overset{2}{a} + \overset{2}{a} \cdot \overset{3}{(-b)} + \overset{3}{(-b)} \cdot \overset{1}{a} + \overset{3}{(-b)} \cdot \overset{4}{(-b)}$$

$$= \overset{1}{a^2} - \overset{2}{ab} - \overset{3}{ba} + \overset{4}{b^2}$$

Simplify the products

$$= a^2 - 2ab + b^2$$

Group like terms

Q. Expand and simplify
 $(n - 3)^2$

A. $(n - 3)^2$
 $= (n - 3)(n - 3)$
 $= \overset{1}{n} \cdot \overset{2}{n} + \overset{2}{n} \cdot \overset{3}{(-3)} + \overset{3}{(-3)} \cdot \overset{1}{n} + \overset{3}{(-3)} \cdot \overset{4}{(-3)}$
 $= n^2 - 3n - 3n + 9$
 $= n^2 - 6n + 9$

OR $(n - 3)^2$
 Using $a^2 - 2ab + b^2$
 where $a = n$ and $b = 3$
 $= n^2 - 2 \cdot n \cdot 3 + 3 \cdot 3$
 $= n^2 - 6n + 9$

a) Expand and simplify
 $(s - 4)^2$

$= a^2 - 2ab + b^2$ where $a = s$ and $b = 4$

$= s^2 - 2 \times s \times 4 + 4^2 = s^2 - 8s + 16$

b) Expand and simplify
 $(k - 1)^2$

$=$ _____
 $=$ _____

c) Expand and simplify
 $(m - 2)^2$

$=$ _____
 $=$ _____

d) Expand and simplify
 $(q - 5)^2$

$=$ _____
 $=$ _____

e) Expand and simplify
 $(j - 7)^2$

$=$ _____
 $=$ _____

f) Expand and simplify
 $(e - 9)^2$

$=$ _____
 $=$ _____

g) Expand and simplify
 $(z - 6)^2 + 8$

$=$ _____
 $=$ _____

h) Expand and simplify
 $(b - 4)^2 - 3b$

$=$ _____
 $=$ _____